

CLAIMS

What is Claimed is:

1. A method of transmitting a coded signal having an upper layer signal and a lower layer signal, comprising the steps of:
 - 5 combining the upper layer signal and the lower layer signal;
 - encoding the combined upper layer signal and lower layer signal;
 - delaying the upper layer signal;
 - modulating the delayed upper layer signal;
 - modulating the lower layer signal;
 - 10 transmitting the delayed upper layer signal; and
 - transmitting the lower layer signal.
2. The method of claim 1, wherein the step of encoding the combined upper layer signal and lower layer signal further comprises the step of inserting
15 timing data into the encoded combined upper layer signal and lower layer signal, the timing data including predetermined lower layer signal data.
3. The method of claim 2, wherein the timing data includes blocks of initialization data.
20
4. The method of claim 2, wherein the timing data is inserted periodically.
5. The method of claim 1, wherein the step of encoding the combined
25 upper layer signal and lower layer signal further comprises the step of inserting timing data into at least a portion of the upper layer signal and into the lower layer signal.

6. The method of claim 5, wherein the timing data includes blocks of initialization data.

7. The method of claim 5, wherein the timing data is inserted
5 periodically.

8. The method of claim 1, wherein the upper layer signal is delayed by an amount of time necessary for a receiver of the transmitted coded signal to remodulate and re-encode a demodulated upper layer signal.

10

9. An apparatus for transmitting a coded signal having an upper layer signal and a lower layer signal, comprising:

15

means for combining the upper layer signal and the lower layer signal;
means for encoding the combined upper layer signal and lower layer signal;
means for delaying the upper layer signal;
means for modulating the delayed upper layer signal;
means for modulating the lower layer signal;
means for transmitting the delayed upper layer signal; and
means for transmitting the lower layer signal.

20

10. The apparatus of claim 9, wherein the means for encoding the combined upper layer signal and lower layer signal further comprises means for inserting timing data into the encoded combined upper layer signal and lower layer signal, the timing data including predetermined lower layer signal data.

25

11. The apparatus of claim 10, wherein the timing data includes blocks of initialization data.

12. The apparatus of claim 10, wherein the timing data is inserted periodically.

13. The apparatus of claim 9, wherein the means for encoding the
5 combined upper layer signal and lower layer signal further comprises means for inserting timing data into at least a portion of the upper layer signal and into the lower layer signal.

14. The apparatus of claim 13, wherein the timing data includes blocks of
10 initialization data.

15. The apparatus of claim 13, wherein the timing data is inserted periodically.

15 16. The apparatus of claim 9, wherein the upper layer signal is delayed by an amount of time necessary for a receiver of the transmitted coded signal to remodulate and re-encode a demodulated upper layer signal.

17. An apparatus for transmitting a coded signal having an upper layer signal and a lower layer signal, comprising:
an encoder, for encoding a combined upper layer signal and lower layer signal;
a delay element, communicatively coupled to the encoder, for delaying the
5 upper layer signal;
a first modulator, for modulating the delayed upper layer signal;
a second modulator, for modulating the lower layer signal;
a transmitter, communicatively coupled to the first modulator, for transmitting the delayed upper layer signal; and
10 a second transmitter, communicatively coupled to the second modulator, for transmitting the lower layer signal.

18. The apparatus of claim 17, wherein the encoder inserts timing data into the encoded combined upper layer signal and lower layer signal, the timing data
15 including predetermined lower layer signal data.

19. The apparatus of claim 18, wherein the timing data includes blocks of initialization data.

20. The apparatus of claim 18, wherein the timing data is inserted periodically.

21. The apparatus of claim 17, wherein the encoder inserts timing data into at least a portion of the upper layer signal and into the lower layer signal.

22. The apparatus of claim 21, wherein the timing data includes blocks of initialization data.

23. The apparatus of claim 21, wherein the timing data is inserted periodically.

24. The apparatus of claim 17, wherein the upper layer signal is delayed by
5 an amount of time necessary for a receiver of the transmitted coded signal to remodulate and re-encode a demodulated upper layer signal.

25. A method of decoding a coded input signal having an upper layer modulated signal and a lower layer modulated signal, comprising the steps of:
10 demodulating the input signal to produce an upper layer signal;
delaying the input signal;
demodulating the delayed input signal to produce a lower layer signal;
combining the upper layer signal and the lower layer signal; and
decoding the combined upper layer signal and the lower layer signal.

15

26. The method of claim 25, wherein:
the coded input signal includes initialization data having predetermined lower layer signal data; and
the combined upper layer signal and the lower layer signal are decoded
20 according to the initialization data.

27. The method of claim 25, wherein:
at least a portion of the coded input signal includes a separately encoded upper layer signal and lower layer signal; and
25 the at least a portion of the coded input signal is decoded according to the initialization data.

28. The method of claim 25, wherein the step of demodulating the delayed input signal to produce a lower layer signal comprises the steps of:

re-encoding and remodulating the upper layer signal;

extracting the lower layer signal from the input signal by subtracting the re-
5 encoded and remodulated upper layer signal from the input signal.

29. The method of claim 28, wherein the input signal is delayed by an amount of time necessary to re-encode and remodulate the upper layer signal.

10 30. The method of claim 25, further comprising the step of de-interleaving the decoded combined upper layer signal and the lower layer signal.

31. An apparatus for decoding a coded input signal having an upper layer modulated signal and a lower layer modulated signal, comprising:

15 means for demodulating the input signal to produce an upper layer signal;

means for delaying the input signal;

means for demodulating the delayed input signal to produce a lower layer
signal;

means for combining the upper layer signal and the lower layer signal; and

20 means for decoding the combined upper layer signal and the lower layer
signal.

32. The apparatus of claim 31, wherein:

the coded input signal includes inserted initialization data having

25 predetermined lower layer signal data; and

the combined upper layer signal and the lower layer signal are decoded
according to the initialization data.

33. The apparatus of claim 31, wherein:
at least a portion of the coded input signal includes a separately encoded upper
layer signal and lower layer signal; and
the at least a portion of the coded input signal is decoded according to the
5 initialization data

34. The apparatus of claim 31, wherein the means for demodulating the
delayed input signal to produce a lower layer signal comprises:
means for re-encoding and remodulating the upper layer signal;
10 means for extracting the lower layer signal from the input signal by subtracting
the re-encoded and remodulated upper layer signal from the input signal.

35. The apparatus of claim 34, wherein the input signal is delayed by an
amount of time necessary to re-encode and remodulate the upper layer signal.
15

36. The apparatus of claim 31, further comprising the step of de-
interleaving the decoded combined upper layer signal and the lower layer signal.

37. An apparatus for decoding a coded input signal having an upper layer modulated signal and a lower layer modulated signal, comprising:

a demodulator for demodulating the input signal to produce an upper layer signal;

5 a delay element, communicatively coupled to the input signal for delaying the input signal;

a second demodulator for demodulating the delayed input signal to produce a lower layer signal, the second demodulator communicatively coupled to the delay element;

10 a combiner for combining the upper layer signal and the lower layer signal, the combiner communicatively coupled to the first demodulator and the second demodulator; and

a decoder, communicatively coupled to the combiner, the decoder for decoding the combined upper layer signal and the lower layer signal.

15

38. The apparatus of claim 37, wherein:

the coded input signal includes inserted initialization data having predetermined lower layer signal data; and

20 the combined upper layer signal and the lower layer signal are decoded according to the initialization data.

39. The apparatus of claim 37, wherein:

at least a portion of the coded input signal includes a separately encoded upper layer signal and lower layer signal; and

25 the at least a portion of the coded input signal is decoded according to the initialization data.

40. The apparatus of claim 37, further comprising:
an encoder communicatively coupled to the decoder, the encoder for re-encoding the upper layer signal;
a modulator, communicatively coupled to the encoder, the modulator for
5 remodulating the upper layer signal; and
a differencer module, communicatively coupled to the modulator and the second demodulator, for extracting the lower layer signal from the input signal by subtracting the re-encoded and remodulated upper layer signal from the input signal.
- 10 41. The apparatus of claim 40, wherein the input signal is delayed by an amount of time necessary to re-encode and remodulate the upper layer signal.
42. The apparatus of claim 37, further comprising a de-interleaver, communicatively coupled to the decoder, the de-interleaver for de-interleaving the
15 decoded combined upper layer signal and the lower layer signal.
43. A method of transmitting a coded signal having an upper layer signal and a lower layer signal, comprising the steps of:
separately and multiplexingly encoding the upper layer signal and lower layer
20 signal;
modulating the separately encoded upper layer signal;
modulating the separately encoded lower layer signal;
transmitting the modulated and separately encoded upper layer signal; and
transmitting the modulated and separately encoded lower layer signal.
- 25 44. The method of claim 43, wherein the upper layer signal and the lower layer signal are encoded by the same code.

45. A method of decoding a coded input signal having an upper layer modulated signal and a lower layer modulated signal, comprising the steps of:
demodulating the input signal to produce an encoded upper layer signal;
demodulating the input signal to produce an encoded lower layer signal;
5 multiplexingly applying the encoded upper layer signal and the encoded lower layer signal to a signal encoder.

46. The method of claim 45, wherein the step of demodulating the input signal to produce an encoded lower layer signal comprises the steps of:
10 re-encoding and remodulating the upper layer signal;
extracting the lower layer signal from the input signal by subtracting the re-encoded and remodulated upper layer signal from the input signal.

47. The method of claim 45, further comprising the step of de-interleaving
15 the decoded combined upper layer signal and the lower layer signal.

48. A method of decoding a coded input signal having an upper layer signal and a lower layer signal, comprising the steps of:
demodulating the coded input signal to produce a coded upper layer signal;
20 demodulating the coded input signal to produce a coded lower layer signal;
and
multiplexingly decoding the coded upper layer signal and the coded second layer signal.

49. The method of claim 48, wherein the step of alternately decoding the coded upper layer signal and the coded second layer signal comprises the step of
25 alternately applying the coded upper layer signal and the coded lower layer signal to a decoder.

50. The method of claim 48, wherein the step of demodulating the coded input signal to produce a coded lower layer signal comprises the steps of
decoding the coded upper layer signal;
5 re-encoding and remodulating the decoded upper layer signal; and
extracting the lower layer signal from coded input signal by subtracting the re-encoded and remodulated upper layer signal from the input signal.

51. An apparatus for transmitting a coded signal having an upper layer
10 signal and a lower layer signal, comprising:
means for separately and multiplexingly encoding the upper layer signal and
lower layer signal;
means for modulating the separately encoded upper layer signal;
means for modulating the separately encoded lower layer signal;
15 means for transmitting the modulated and separately encoded upper layer
signal; and
means for transmitting the modulated and separately encoded lower layer
signal.

20 52. The apparatus of claim 51, wherein the upper layer signal and the
lower layer signal are encoded by the same code.

53. An apparatus for decoding a coded input signal having an upper layer modulated signal and a lower layer modulated signal, comprising:

means for demodulating the input signal to produce an encoded upper layer signal;

5 means for demodulating the input signal to produce an encoded lower layer signal;

means for multiplexingly applying the encoded upper layer signal and the encoded lower layer signal to a signal decoder.

10 54. The apparatus of claim 53, wherein the means for demodulating the input signal to produce an encoded lower layer signal comprises:

means for re-encoding and remodulating the upper layer signal;

means for extracting the lower layer signal from the input signal by subtracting the re-encoded and remodulated upper layer signal from the input signal.

15

55. The apparatus of claim 54, further comprising means for de-interleaving the decoded combined upper layer signal and the lower layer signal.

20 56. An apparatus for decoding a coded input signal having an upper layer signal and a lower layer signal, comprising:

means for demodulating the coded input signal to produce a coded upper layer signal;

means for demodulating the coded input signal to produce a coded lower layer signal; and

25 means for multiplexingly decoding the coded upper layer signal and the coded second layer signal.

57. The apparatus of claim 56, wherein the means for alternately decoding the coded upper layer signal and the coded second layer signal comprises means for alternately applying the coded upper layer signal and the coded lower layer signal to a decoder.

5

58. The method of claim 56, wherein the means for demodulating the coded input signal to produce a coded lower layer signal comprises:

means for decoding the coded upper layer signal;

means for re-encoding and remodulating the decoded upper layer signal; and

10 means for extracting the lower layer signal from coded input signal by subtracting the re-encoded and remodulated upper layer signal from the input signal.

59. An apparatus for transmitting a coded signal having an upper layer signal and a lower layer signal, comprising:

15 a multiplexer for separately and multiplexingly applying the upper layer signal and lower layer signal to an encoder;

a modulator, communicatively coupled to the encoder, for modulating the separately encoded upper layer signal;

20 a second modulator, communicatively coupled to the encoder, for modulating the separately encoded lower layer signal;

a transmitter, communicatively coupled to the modulator, the transmitter for transmitting the modulated and separately encoded upper layer signal; and

a second transmitter, coupled to the second modulator, the second transmitter for transmitting the modulated and separately encoded lower layer signal.

25

60. The apparatus of claim 59, wherein the upper layer signal and the lower layer signal are encoded by the same code.

61. An apparatus for decoding a coded input signal having an upper layer modulated signal and a lower layer modulated signal, comprising:

a first demodulator for demodulating the input signal to produce an encoded upper layer signal;

5 a second demodulator for demodulating the input signal to produce an encoded lower layer signal;

a multiplexer, communicatively coupled to the first demodulator and the second demodulator, the multiplexer for multiplexingly applying the encoded upper layer signal and the encoded lower layer signal to a signal decoder.

10

62. The apparatus of claim 61, further comprising:

an encoder, communicatively coupled to the decoder, for re-encoding the upper layer signal;

15 a modulator, communicatively coupled to the encoder, the modulator for remodulating the re-encoded upper layer signal;

an extractor, communicatively coupled to the modulator and the second demodulator, the extractor for extracting the lower layer signal from the input signal by subtracting the re-encoded and remodulated upper layer signal from the input signal.

20

63. The apparatus of claim 62, further comprising a de-interleaver, communicatively coupled to the decoder.